

Application No. 10/629,441
Amendment dated November 28, 2005
Reply to Office Action of October 7, 2005

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Previously Presented) A taking lens apparatus comprising:
 - a zoom lens system that is composed of a plurality of lens units and that achieves zooming by varying distances between the lens units; and
 - an image sensor that converts an optical image formed by the zoom lens system into an electrical signal;
 - wherein the zoom lens system comprises:
 - a first lens unit that is disposed at an object-side end of the zoom lens system, that has a negative optical power as a whole, and that remains stationary relative to the image sensor during zooming of the zoom lens system, the first lens unit including a cemented lens element, the cemented lens element including a negative lens element and a positive lens element;
 - a second lens unit that is disposed on an image-sensor side of the first lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an object side during zooming of the zoom lens system from a wide-angle end to a telephoto end; and
 - a third lens unit that is disposed on an image-sensor side of the second lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an image side during initial zooming from the wide-angle end to the telephoto end.
 2. (Original) A taking lens apparatus as claimed in claim 1, wherein the third lens unit moves toward an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

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3. (Original) A taking lens apparatus as claimed in claim 1, wherein the third lens unit moves along a U-shaped trajectory convex to an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

4. (Original) A taking lens apparatus as claimed in claim 1, wherein the first lens unit includes an aspherical surface.

5. (Original) A taking lens apparatus as claimed in claim 1, wherein an aperture stop is disposed between the first and second lens units.

6. (Original) A taking lens apparatus as claimed in claim 1, wherein an aperture stop is disposed between the second and third lens units.

7. (Original) A taking lens apparatus as claimed in claim 1, wherein the zoom lens system includes an aperture stop that moves together with the second lens unit during zooming.

8. (Original) A taking lens apparatus as claimed in claim 1, wherein the zoom lens system includes an aperture stop that remains stationary relative to an image plane during zooming.

9. (Original) A taking lens apparatus as claimed in claim 1, wherein the third lens unit is composed of a plurality of lens elements.

10. (Previously Presented) A taking lens apparatus as claimed in claim 1, wherein the following condition is fulfilled:

$$2.5 < Dref / Ymax < 4$$

where

Dref represents an axial distance between a most object-side optical component of the first lens unit and a next most object-side optical component of the first lens unit; and

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Y_{max} represents a maximum image height.

11. (Original) A taking lens apparatus as claimed in claim 1, wherein the following condition is fulfilled:

$$1.0 < (f_t \cdot m_{2w}) / (f_w \cdot m_{2t})$$

where

f_w represents a focal length of the zoom lens system as a whole at the wide-angle end;

f_t represents a focal length of the zoom lens system as a whole at the telephoto end;

m_{2w} represents an imaging magnification of the second lens unit at the wide-angle end; and

m_{2t} represents an imaging magnification of the second lens unit at the telephoto end.

12. (Original) A taking lens apparatus as claimed in claim 1, wherein focusing is achieved by moving the third lens unit.

13. (Previously Presented) A taking lens apparatus as claimed in claim 1, wherein the most object-side optical component of the first lens unit is comprised of one lens element.

14. (Previously Presented) A taking lens apparatus comprising:
a zoom lens system that is composed of a plurality of lens units and that achieves zooming by varying distances between the lens units; and

an image sensor that converts an optical image formed by the zoom lens system into an electrical signal;

wherein the zoom lens system comprises:

a first lens unit that is disposed at an object-side end of the zoom lens system, that has a negative optical power as a whole, that includes a reflective member for bending an optical axis of the zoom lens system as a whole at substantially 90°, and that

remains stationary relative to the image sensor during zooming of the zoom lens system;
a second lens unit that is disposed on an image-sensor side of the first lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an object side during zooming of the zoom lens system from a wide-angle end to a telephoto end; and

a third lens unit that is disposed on an image-sensor side of the second lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an image side during initial zooming from the wide-angle end to the telephoto end, the third lens unit including a plurality of lens elements.

15. (Original) A taking lens apparatus as claimed in claim 14, wherein the third lens unit moves toward an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

16. (Original) A taking lens apparatus as claimed in claim 14, wherein the third lens unit moves along a U-shaped trajectory convex to an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

17. (Original) A taking lens apparatus as claimed in claim 14, wherein the first lens unit includes an aspherical surface.

18. (Original) A taking lens apparatus as claimed in claim 14, wherein an aperture stop is disposed between the first and second lens units.

19. (Original) A taking lens apparatus as claimed in claim 14, wherein an aperture stop is disposed between the second and third lens units.

20. (Original) A taking lens apparatus as claimed in claim 14, wherein the zoom lens system includes an aperture stop that moves together with the second lens unit during zooming.

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21. (Original) A taking lens apparatus as claimed in claim 14, wherein the zoom lens system includes an aperture stop that remains stationary relative to an image plane during zooming.

22. (Canceled)

23. (Original) A taking lens apparatus as claimed in claim 14, wherein the following condition is fulfilled:

$$2.5 < Dref / Ymax < 4$$

where

Dref represents a sum of axial distances between an object-side optical component located immediately in front of the reflective member and an image-side optical component located immediately behind the reflective member; and

Ymax represents a maximum image height.

24. (Previously Presented) A taking lens apparatus as claimed in claim 14, wherein the following condition is fulfilled:

$$1.0 < (ft \cdot m2w) / (fw \cdot m2t)$$

where

fw represents a focal length of the zoom lens system as a whole at the wide-angle end;

ft represents a focal length of the zoom lens system as a whole at the telephoto end;

m2w represents an imaging magnification with the second lens unit at the wide-angle end; and

m2t represents an imaging magnification with the second lens unit at the telephoto end.

25. (Original) A taking lens apparatus as claimed in claim 14, wherein focusing is achieved by moving the third lens unit.

26. (Original) A taking lens apparatus as claimed in claim 14, wherein only one lens element is disposed on an object side of the reflective member.

27. (Previously Presented) A camera comprising:
a taking lens apparatus including a zoom lens system that is composed of a plurality of lens units and that achieves zooming by varying distances between the lens units and an image sensor that converts an optical image formed by the zoom lens system into an electrical signal;

wherein the zoom lens system comprises:

a first lens unit that is disposed at an object-side end of the zoom lens system, that has a negative optical power as a whole, and that remains stationary relative to the image sensor during zooming of the zoom lens system, the first lens unit including a cemented lens element, the cemented lens element including a negative lens element and a positive lens element;

a second lens unit that is disposed on an image-sensor side of the first lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an object side during zooming of the zoom lens system from a wide-angle end to a telephoto end; and

a third lens unit that is disposed on an image-sensor side of the second lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an image side during initial zooming from the wide-angle end to the telephoto end.

28. (Original) A camera as claimed in claim 27, wherein the third lens unit moves toward an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

29. (Original) A camera as claimed in claim 27, wherein the third lens unit moves along a U-shaped trajectory convex to an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

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30. (Original) A camera as claimed in claim 27, wherein the first lens unit includes an aspherical surface.

31. (Original) A camera as claimed in claim 27, wherein an aperture stop is disposed between the first and second lens units.

32. (Original) A camera as claimed in claim 27, wherein an aperture stop is disposed between the second and third lens units.

33. (Original) A camera as claimed in claim 27, wherein the zoom lens system includes an aperture stop that moves together with the second lens unit during zooming.

34. (Original) A camera as claimed in claim 27, wherein the zoom lens system includes an aperture stop that remains stationary relative to an image plane during zooming.

35. (Original) A camera as claimed in claim 27, wherein the third lens unit is composed of a plurality of lens elements.

36. (Previously Presented) A camera as claimed in claim 27, wherein the following condition is fulfilled:

$$2.5 < Dref / Ymax < 4$$

where

Dref represents an axial distance between a most object-side optical component of the first lens unit and a next most object-side optical component of the first lens unit; and

Ymax represents a maximum image height.

37. (Original) A camera as claimed in claim 27, wherein the following condition is fulfilled:

$$1.0 < (ft \cdot m2w) / (fw \cdot m2t)$$

where

- fw represents a focal length of the zoom lens system as a whole at the wide-angle end;
- ft represents a focal length of the zoom lens system as a whole at the telephoto end;
- m2w represents an imaging magnification of the second lens unit at the wide-angle end; and
- m2t represents an imaging magnification of the second lens unit at the telephoto end.

38. (Original) A camera as claimed in claim 27, wherein focusing is achieved by moving the third lens unit.

39. (Previously Presented) A camera as claimed in claim 27, wherein the most object-side optical component of the first lens unit is comprised of one lens element.

40. (Previously Presented) A camera comprising:
a taking lens apparatus including a zoom lens system that is composed of a plurality of lens units and that achieves zooming by varying distances between the lens units and an image sensor that converts an optical image formed by the zoom lens system into an electrical signal;

wherein the zoom lens system comprises:

a first lens unit that is disposed at an object-side end of the zoom lens system, that has a negative optical power as a whole, that includes a reflective member for bending an optical axis of the zoom lens system as a whole at substantially 90°, and that remains stationary relative to the image sensor during zooming of the zoom lens system;

a second lens unit that is disposed on an image-sensor side of the first lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an object side during zooming of the zoom lens system

from a wide-angle end to a telephoto end; and

a third lens unit that is disposed on an image-sensor side of the second lens unit with a variable aerial distance secured in between, that has a positive optical power as a whole, and that moves toward an image side during initial zooming from the wide-angle end to the telephoto end, the third lens unit including a plurality of lens elements.

41. (Original) A camera as claimed in claim 40, wherein the third lens unit moves toward an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

42. (Original) A camera as claimed in claim 40, wherein the third lens unit moves along a U-shaped trajectory convex to an image side during zooming of the zoom lens system from the wide-angle end to the telephoto end.

43. (Original) A camera as claimed in claim 40, wherein the first lens unit includes an aspherical surface.

44. (Original) A camera as claimed in claim 40, wherein an aperture stop is disposed between the first and second lens units.

45. (Original) A camera as claimed in claim 40, wherein an aperture stop is disposed between the second and third lens units.

46. (Original) A camera as claimed in claim 40, wherein the zoom lens system includes an aperture stop that moves together with the second lens unit during zooming.

47. (Original) A camera as claimed in claim 40, wherein the zoom lens system includes an aperture stop that remains stationary relative to an image plane during zooming.

48. (Canceled)

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49. (Original) A camera as claimed in claim 40, wherein the following condition is fulfilled:

$$2.5 < Dref / Ymax < 4$$

where

Dref represents a sum of axial distances between an object-side optical component located immediately in front of the reflective member and an image-side optical component located immediately behind the reflective member; and

Ymax represents a maximum image height.

50. (Previously Presented) A camera as claimed in claim 40, wherein the following condition is fulfilled:

$$1.0 < (ft \cdot m2w) / (fw \cdot m2t)$$

where

fw represents a focal length of the zoom lens system as a whole at the wide-angle end;

ft represents a focal length of the zoom lens system as a whole at the telephoto end;

m2w represents an imaging magnification with the second lens unit at the wide-angle end; and

m2t represents an imaging magnification with the second lens unit at the telephoto end.

51. (Original) A camera as claimed in claim 40, wherein focusing is achieved by moving the third lens unit.

52. (Original) A camera as claimed in claim 40, wherein only one lens element is disposed on an object side of the reflective member.

53. – 60. (Canceled)